

# Einstein's Postulates

Results of  $\mu : \mu : \mu_0$  ether (At least no ability to measure it's existence)

- $\therefore$  EM waves propagate in a Vacuum
- So,  $c$  is relative to whom?

$P_1$ : Absolute uniform motion cannot be detected

$\Rightarrow$  only "relative" motion, no such thing as "absolute" motion

$\Rightarrow$  No preferred reference frame

$\Rightarrow$  No "absolute space" or "ether frame" This at rest

$P_2$ : The velocity of light does not depend upon the velocity of the source

• These postulates imply that  $c = c'$ , for all inertial observers

i.e Thrown rocks do not obey 2<sup>nd</sup> postulate.

$$\vec{V}_{\text{Rock, you}} = \vec{V}_{\text{Rock, car}} + \vec{V}_{\text{car, you}}$$

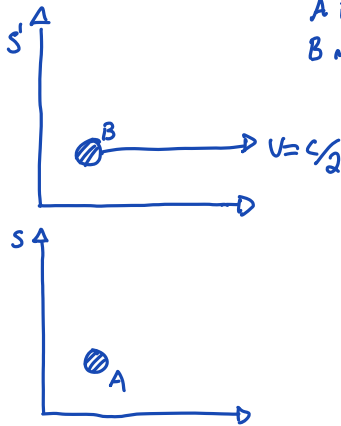
i.e Sound does obey the 2<sup>nd</sup> postulate

$$V_{\text{sound}} \approx 330 \text{ m/s (w.r.t Air)}$$

For light, there is no ether  $\therefore$

Light must obey the 2<sup>nd</sup> Postulate in all I.R.F's

Consider two spaces, A: B



A is in the same I.R.F as Searchlight  
B moves w/speed  $V = c/2$  relative to A: Spaceship

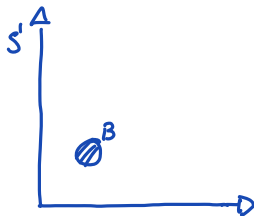


Speed of light according to A?

$$V_x = -c$$

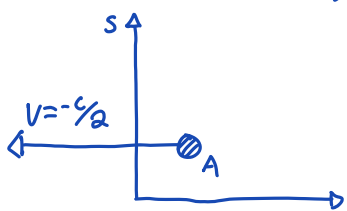
Speed of light according to B?

$$V_x' = -c$$



PI: According to  $S'$  Frame, B is at rest: Searchlight moves w/speed  $-c/2$

PII: Velocity of light doesn't depend on the speed of the source



## Spheres of light

At time  $t'$ , what do  $S'$  observers see?



- Consider  $S'$  moving @ Speed  $V$  relative to  $S$
- Coordinate systems origins align @  $t = t' = 0$
- Lightbulb flashes at origin @  $t = t' = 0$

